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ABSTRACT

The three learning modules in this package are designed to provide elementary school teachers with exploratory level learning activities that will encourage students to understand technology and become technologically literate. The package is organized around the following major content areas: (1) computer technology--in which students use microcomputers in computer assisted instructional programs; (2) problem solving--in which students learn a method for practical problem solving; and (3) communications technology--in which a history of communications and telecommunications is provided along with a discussion of telephones and communications satellites. The three modules are structured so that they can be used individually or together as a unit of technology instruction. Each module includes a title sheet, rationale and purpose, goal statement, performance objectives, list of tasks, suggested application activities, and elementary subject-matter correlation. It is suggested that modules be used as an enhancement to existing curriculum. Lists of technology resource journals and computer programs conclude the report. (26 references) (DB)

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ELEMENTARY SCHOOL TECHNOLOGY EDUCATION

A MODULAR RESOURCE PACKAGE

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ELEMENTARY SCHOOL TECHNOLOGY EDUCATION

A Modular Resource Package

INTRODUCTION

The advancement of technology into almost every aspect of our lives has left us with an almost overwhelming responsibility in preparing our students to live and cope with change. Leaders in technology tell us that the body of knowledge that we are responsible for is doubling every five years, some even say it is less than that.

Our traditional teaching methods and facilities have left us ill prepared to deal with such a rapidly changing phenomenon. We, in education, have traditionally been the slowest to react to change, but now we are faced with the responsibility of educating students about the fastest changing aspect of our society.

Today's elementary school students will live in a society that demands an understanding of technology. As we move toward the next century, technological literacy will become increasingly important to all citizens. It is necessary, therefore, to begin preparing children for the responsibilities of citizenship in a technological society as soon as possible, i.e. the elementary school.

For the purposes of this project, **technology is defined as a body of knowledge and application of resources to produce results in response to human needs and wants.** Technological literacy, therefore, is the possession of a reasonable understanding of technical means used for survival, and its context within our society.

This modular resource package is written to provide elementary school teachers with exploratory level technology activities. It includes goals for implementing technology and suggestions for the enhancement of existing elementary curriculum.

The package is organized around the following major content organizers: Computer Technology, Problem Solving, and Communication Technology. Each of the titles will be used to form the bases for a module.

The time allotted to each module activity will vary depending on the skill level of each student, the amount of equipment available for use, and the scheduled class time. It is the intent of the writers that each module be used as an enhancement to existing curriculum and not simply integrated into an already full curriculum.

The modules are designed to be used as a guide by the teacher. They are not prepared for distribution to students. However, the activities section may include handout information that teachers may wish to duplicate and give to children. In many instances, students will require only a basic introduction to a concept and then each student can proceed individually through the activity objectives. Small group work and peer instruction are highly successful methods to expand concepts and approach problem solving activities.

The modules are structured so that they can be used individually or together as a unit of technology instruction. Each module includes the following items: Title Sheet, Rationale & Purpose, Goals, Performance Objectives, Tasks, Suggested Application Activities and Elementary Subject-matter Correlation.

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MODULE 1

-Computer Applications-

Written by: Melvin J. Pedras, Ed.D.

Spring 1991

COMPUTER APPLICATIONS
Module 1

Rationale and Purpose:

Although computers have been commonplace in business and research for many years, the significant breakthrough in computers for education developed in the late 1970s with the introduction of affordable personal computers (PCs). PCs are used to transmit, process, store, and retrieve data. The PC, however is not a magical panacea; it is a tool requiring the same careful use as any other educational device.

Since computers are becoming commonplace tools, it seems plausible that students should be taught how to use them preferably at an early age.

This module will help students learn to use a computer as a tool. They will be involved with activities such as word processing, computer aided drawing and problem solving.

This first module will introduce computers to students, however, it is hoped that the teacher will integrate computers into all modules included in this package. Students should be instructed in the value of the computer as a tool.

INSTRUCTIONAL GOAL #1

Prepare a technology related document using word processing software.

Performance Objective #1:

Given a picture of computer hardware, identify the major parts of a computer system.

Tasks:

1. Identify a keyboard input device.
2. Identify a Central Processing Unit (CPU).
3. Identify an output device such as a printer.

Suggested Application Activities:

1. Label a picture of a computer system.(See Resource Package)
2. Point to actual computer hardware components in the classroom.
3. Color, cutout and paste pictures of a computer system into a proper organization.
4.

Performance Objective #2:

Given appropriate computer hardware and software, produce an edited hardcopy of a technology document.

Tasks:

1. Boot a word processing program.
2. Demonstrate keyboarding skills.
3. Demonstrate simple procedure for editing text.
4. Properly initialize a blank disk.
5. Demonstrate the proper use of a printer to produce a hard copy.
6. Demonstrate how to save and retrieve a document.

Suggested Application Activities:

1. Research and compose a report on a science, social studies, language arts or reading topic using word processing software.
2. Write a letter to a parent or friend. Produce a hardcopy using a printer. Save the letter for future reference.
3. Retrieve the letter from above, modify and send to another person.
4.

INSTRUCTIONAL GOAL #2

Create a computer aided drawing.

Performance Objective #1:

Given computer aided drawing (CAD) software, produce a drawing.

Tasks:

1. Boot a CAD program.
2. Identify and explain the purpose of CAD hardware.
3. Explain the drawing features of a CAD program.
4. Demonstrate how to produce a simple CAD drawing.
5. Demonstrate how to save a drawing for future use.

Suggested Application Activities:

1. Use CAD software to draw simple geometric figures.
2. Use CAD software to draw a simple house.
3. Use CAD software to draw a simple floor plan.
4.

INSTRUCTIONAL GOAL #3

Design and build a mechanical object.

Performance Objective #1:

Given appropriate software, design and build a useful mechanical object.

Tasks:

1. Properly load software.
2. Identify object to be designed.
3. Demonstrate design procedure.
4. Produce hard copy of object.
5. Construct object.

Suggested Application Activities:

1. Using ToyShop, design and create a mechanical object that moves.
2. Design and create a useful product for use in the classroom.
3.

INSTRUCTIONAL GOAL #4

Create a technology-related document using desktop publishing software.

Performance Objective #1:

Using desktop software, design and produce a technology-related document.

Tasks:

1. Correctly load desktop software.
2. Design a technology slogan.
3. Set-up a printer to produce a hardcopy.

Suggested Application Activities:

1. Using PrintShop, produce a banner with a technology slogan such as: TECHNOLOGY: Our Future, We Speak Technology, etc.
2. Produce an invitation for a technology fair at your school
3. Design and produce a technology poster.
4.

Subject Matter Correlation:

Math

1. Compute the distance around simple geometric figures.
2. Compute the area within simple geometric figures.
3. Compute the square area of a simple floor plan.
4.

Science

1. Explain how a scientist might use a computer.
2. Demonstrate how a computer can be used to perform a scientific experiment. (Use Science ToolKit)
4.

Reading/Spelling and Language Arts

1. Explain the difference between a spoken language and a computer language.
2. Demonstrate basic writing skills by preparing a letter.
3.

Social Studies

1. Discuss the role of computers in our daily lives.
2. Trace the historical development of the computer.
3. Discuss how computers are used in the local community by:
    a. business and industry
    b. city and county agencies
    c. schools
    d. private individuals
4.

P. E. and Health

1. Talk with a local health professional and identify health hazards associated with the use of computers.
2. Explain how computers have contributed to better health care.
3.

Problem Solving

1. Demonstrate how to use the computer to solve a problem. (Escape from Rungistan), others
2. Demonstrate how to use a simulation program.
3. Design a crossword puzzle.
4.

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MODULE 2

-Problem Solving-

Written by: Melvin J. Pedras, Ed.D.

Spring 1991

PROBLEM SOLVING
Module 2

Rationale and Purpose:

Human being have always been faced with problems and have always tried to solve them. Physical and biological needs, like the needs for shelter, food, clothing, and health care, cause us to invent technological means to make life easier. The solutions we employ are based upon the most up-to-date resources available.

Problem solving as an approach to learning crosses subject boundaries and is one of the basis of good teaching practice. There is no mystique to a genuine problem solving approach, neither should there be a binding or restrictive methodology. However, several models for problem solving can be used as a guide while working with children.

The first method would involve practical problem solving activities and would follow the following sequence:

1. What is the problem? (teacher would have to keep the objective of the exercise in mind.)
2. Brainstorming and discussing possible solutions.
3. Choosing the solutions most likely to achieve the desired result.
4. Can the solution work with the resources available?
5. Try out the best idea.
6. Test the chosen solution.
7. Evaluate the results.
8. Modify if necessary.

A second model is the Design Brief approach and would involve the following steps:

1. SITUATION - This is where the need to design is established.

2. BRIEF - This is a statement of the problem to be solved.

3. SPECIFICATION - A statement of the minimum requirements necessary to solve the design problem.
4. INVESTIGATION - This means finding out more about the design problem, making suggestions for solving each part of the problem and deciding what has to be done and how to do it.

5. SOLUTION - At this stage the idea is selected which best suits the needs of the design problem.

6. REALIZATION - This is a hands-on step that requires the actual making of an object.

7. TESTING - In this step, a decision is made whether the object solves the problem outlined in the design brief.

Children learn best when there is a sense of purpose, motivation, and work grounded in first-hand experience. Activities selected by teachers for use with children should be based on investigation, experience and inquiry, and should stimulate creative thought, inventiveness, and the development of manipulative skills. The work should also involve the children in group-work where cooperation is necessary and communication skills are developed

*See Resource Package Figures 1 & 2 of problem solving models that can be shown to children. See also Resource Package for example problems.

INSTRUCTIONAL GOAL #1

Solve a technology related problem using a logical problem solving approach.

Performance Objective #1:

Given a design brief, follow an investigation sequence and select a workable solution for a problem.

Tasks:

1. Identify and discuss a problem situation.
2. Define and explain a problem to be solved.

3. List possible constraints to a problem solution.
4. List potential solutions to an identified problem.
5. Experiment with best problem solution.

Suggested Application Activities:

*See Resource Package for additional sample problems

1. Design and construct a container that will protect an uncooked egg dropped from a one or two story height.
2. Design a map system that will guide a visitor around your school.
3. Design and construct a holder for up to four pencils or pens.
4. Design the tallest, freestanding tower possible using only spaghetti, marshmallows and masking tape.
5.

Subject Matter Correlation:

Math

1. Perform common measurements such as perimeter and area of rectangle and squares.
2. Divide a line into equal and proportional parts.
3. Read a measuring tape, yard stick or other linear measuring device.
4.

Science

1. Perform a simple science experiment and record the results.
2. Discuss what is meant by the scientific method of investigation.
3. Explain the difference between technology and science.
4.

Reading/Spelling and Language Arts

1. Interview an engineer or scientist and discuss how he/she identifies problems and seeks answers.
2. Explain how solutions to problems can cause more problems.
3.

Social Studies

1. List and discuss one or more problems that computers have caused for society.
2. How can people who are afraid of using computers be helped to overcome their fear.
3.

P.E. and Health

1. Investigate and report how technology is being used in your community to address community health problems.
2.

Problem Solving

*See Appendix for numerous examples of problems to be solved.

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MODULE 3

-COMMUNICATIONS TECHNOLOGY-

Written by: Christi Jackson, M.S.

Spring 1991

COMMUNICATIONS TECHNOLOGY
Module 3

Rationale and Purpose

Like all other forms of technology, communication systems are tools and ideas developed to meet society's needs and wants. They serve to extend human sensory perceptions. Our information society today operates with nearly instant communication which is available in almost all parts of the world.

Through languages, alphabets and writing, communication and information technologies have come to be what they are today. Electronic communications enable us as a society to do such things as promote world peace, aid during national and international disasters, and create a cleaner environment for our global society. We are aware of needs among peoples of all cultures. With this awareness a certain social responsibility comes about. Delivering timely educational, humanitarian understanding and acceptance of differences throughout the world is possible. Extending human sensory perceptions has never been as important as it is today.

Application of knowledge presented through the information and activities in this teaching module should enable students to learn and use the concept of communications. The module will include a study of the history of communication, information exchange systems, audio/visual production, satellites and lasers.

Through the role of 'technologists', students will develop critical thinking skills. As their interest in technology is stimulated through the understanding of particular tools and ideas, they will become aware of systems inter-relatedness and realize the application of technology to their everyday lives. This will enhance other subjects they are already studying in the classroom.

INSTRUCTIONAL GOAL #1

Trace the history of communication systems.

Performance Objective #1:

Given appropriate information, identify the evolution of a communication system.

Tasks:

1. Use a technology timeline and identify three communication inventions. (See Resource Package for supporting data)
2. Use an encyclopedia or other source and gather information on the above inventions.
3. Construct a picture display of a modern communication system.
4. Contact a local history organization and request information on historical communication objects in their collection.

Suggested Application Activities:

1. Draw a timeline for the invention of the telephone or another communication device.
2. Make a report to the class about a communication invention.
3. Working in small groups, identify a communication system such as a computer, modem, and telephone, and report on the connection among the items.
4. Share an historic object with the class and demonstrate its use.
5. Take a field trip to a local museum.
6. Invite someone from the community who can talk about communications as it was used by an older generation.
7.

INSTRUCTIONAL GOAL #2

Demonstrate how information is exchanged between humans and machines.

Performance Objective #1:

Given appropriate instruction, demonstrate human to human communication.

Tasks:

1. Students will stand in a circle formation and relay a message through whispering in the ear of the person on their left. When the message has passed completely around the circle, the last person to receive it says it out loud. The person who started it then verifies whether it is accurate or not.
2. Following the same instructions as above, a message is sent by squeezing the hand of the person standing next to each student instead of whispering.
3. Using the classroom chalkboard, students are asked to compile a list of ways people communicate person to person.

Suggested Application Activities:

1. Working in small groups, create a story of a town or village where people rely on personal contact as a sole means for communication.
2. Choose a hypothetical situation with a central message to be communicated. Act out the story created in a skit.
3. Discuss perceptions of the class, comparing the small group presentations.
4.

Performance Objective #2:

Given appropriate information, demonstrate human to machine communication.

Tasks:

1. List ways people in the classroom can communicate through human to machine contact.
2. Using an 8 1/2" x 11" piece of paper, illustrate how people and machines communicate together.

Suggested Application Activities:

1. Students will keep a journal for one week logging instances where they communicated through the use of a machine.

2. Set up communications centers around the room; identify those already in operation.
3. Discuss careers with people working directly in information settings where they use a machine to communicate.
4. Invite someone from the telephone company, or an individual who works as a dispatcher within the community to come and talk about their job.
5. Create a mural of a school information system.
6.

Performance Objective #3

Given a picture of a telephone, identify its major parts and label them accordingly.

Tasks:

1. Using an overhead projector, fill in numbers on telephone buttons. Emphasize emergency number 911.
2. Distribute copies of a blank telephone face and have each student fill in the numbers. Allow each student the opportunity to share a home telephone number with the class (See Resource Package for additional information)

Suggested Application Activities:

1. Compile a classroom telephone directory.
2. Create a telephone tree with numbers from students in the class.
3. Invite an employee from the local telephone company to come into the classroom and answer questions about how information travels through telephones.
4. Visit the telephone company on a field trip.
5. List jobs related to telephone industries.
6. If phone hook-ups are available, have students practice making calls in the classroom.
7.

Performance Objective #4:

Given appropriate information, construct an 'information machine'.

Tasks:

1. Working in small groups, identify some of the early inventions used with the telegraph.
2. From a preplan, construct an information machine. (See Resource Package)
3. Invent an information machine using group process.

Suggested Application Activities:

1. Locate constructed information machines around the classroom and use during a class period.
2. Create a 'classroom' code for communicating important messages and operate it with machines located around the room.
3. Assume student roles as information receivers and dispatchers.
4.

Performance Objectives #5:

Given 'information technology' illustrations, compare various storage and retrieval systems.

Tasks:

1. Construct a picture display of a modern communication system. (See Resource Package)
2. Using a dictionary or other source book for information on the term "convergence" as it applies to bringing together communications systems.
3. Create an inventory of systems known to man, throughout the world.
4. Locate information storage and retrieval systems in the community and identify their connections. (Ex. - Satellite system located on roof of local Safeway store)
5. Obtain a copy of Federal Communications Commission regulations and use as a reference tool in the classroom.

Suggested Application Activities:

1. Visit a local facility where students may learn about storage and retrieval systems firsthand.
2. Search for articles on communications issues in local, national and international newspapers. Collect pertinent articles and post in the classroom.
3. Discuss current issues and problem-solve them in the context of classroom sharing.
4. Contact another class across the country or world and communicate with them about their systems. Compare local technologies.
5. If a satellite communications system is available in the area, schedule some class time for program viewing.
6. Have students take an inventory of television stations received at home and determine how they are able to receive them.
7.

INSTRUCTIONAL GOAL #3

Prepare an audio/visual production

Performance Objective #1:

Given appropriate instructions, students will develop a message to be communicated to a larger audience.

Tasks:

1. Using a story board, develop a script to produce a video tape. (See Resource Package)
2. While students are in the process of developing above script, obtain appropriate media for producing their creation. If a video machine is available, demonstrate its use.
3. Using small groups, develop a message using either audio, visual or audio/visual communication systems. (See Resource Package)
4. Prepare a technology related radio commercial.

Suggested Application Activities:

1. Visit a local television station and research the various jobs required to produce a television show.

2. Invite a local television personality or DJ to class to talk about careers involved with their occupations.
3. Research the historical development of television and give an oral report to the class. Write a report on your findings.
4.

INSTRUCTIONAL GOAL #4

Demonstrate an understanding of communication satellite technology.

Performance Objective #1:

Using references for information, research and present descriptions of satellites in space and explain how they beam messages.

Tasks:

1. On a blank piece of paper, draw a simple illustration of a satellite operation. (See Resource Package)
2. Identify uses for satellites.
3. Describe how satellites stay in orbit.
4. List different types of satellites.
5. Describe how satellites operate and utilize energy.

Suggested Application Activities:

1. Research and report on the following:
    a. How many satellites are currently in space?
    b. How many satellites currently in space are operational?
    c. What is the average lifespan of a satellite?
    d. How far out in space are the satellites?
    e. When was the first satellite sent into space?
2. Explain the limitations of satellites based on their locations.
3. Display a satellite chart in the classroom.
4. Write a story about one of the following:
    a. The life of a satellite.
    b. The birth of a satellite.
    c. The death of a satellite.

5. Asking the question, 'where do old satellites go to die?', speculate and research the issue of garbage in space.
6.

Performance Objective #2:

Using information gathered in Objective #1, draw and construct a satellite to be hung from the classroom ceiling as suspended in space.

Tasks:

1. Research a satellite to be constructed.
2. Collect appropriate materials for the construction of a model satellite.
3. Establish class parameters for actual model satellite construction.
4. Write descriptions of satellite operations.

Suggested Application Activities:

*See Resource Package for support information
1. Construct a model satellite and display in classroom.
2. Construct a broadcast and receiving station.
3. Design and develop a 'workplace' with satellite and antenna dishes in place.
4. Write description of satellite operations in the classroom.
5.

Performance Objective #3:

Using a logical problem problem solving approach, implement a newly created satellite system into a classroom organization.

Tasks:

1. Photograph components of a communications system.
2. Create a schematic of operations to demonstrate use of a satellite system.
3. Organize a classroom project operation and implement.

Suggested Application Activities:

1. Photograph components of a communication system created for classroom use.
2. Stage a 'special operations' day and invite the press in to observe.
3. Invite a school administrator into the classroom to review and evaluate classroom operations.
4.

INSTRUCTIONAL GOAL #5

Create a futuristic scenario using information on optical communications with lasers.

Performance Objective #1:

Following a simple explanation of laser optics, demonstrate awareness of innovations brought into telecommunications through this newest technology.

Tasks:

1. Using an encyclopedia and other sources of information, share facts about fiber optics. (See Resource Package)
2. Report on the use of binary codes.
3. Explain how lasers are made and used. (See Resource Package)
4. Illustrate the purpose and difference between an audio record and a compact disc.
5. Show and explain how a bar code is read.

Suggested Applications Activities:

1. Collect magazine and newspaper articles about fiber optics and how they are used in communications throughout the world.
2. Write a short story about how fiber optics may lead to other creative means for meeting needs around the world.
3. Visit a local phone, cable or utility company and bring a sample of fiber optic material for class display.
4. Identify places where fiber optics are replacing outmoded communication systems. Write a short report on the difference this new technology will or is making in our society.

5. Assuming the role of 'technologist", identify social responsibilities with regard to the latest developments in communication and information technology.
6. Show and compare the operation of a record player and a compact disc.
7. Bring samples of a bar code to class and illustrate how they are read.
8. Invite a technology teacher to give a demonstration to the class on lasers.
9.

Subject Matter Correlation:

Math

1. Perform measurements and describe limitations of time and space with regard to systems delivery.
2. Determine economic feasibility balancing cause and effect with regard to production and operation of a system.
3. Research historic math wizards who are or have been the brains behind modern technology.
4. Conduct research regarding data gathering and use such as: defining statistics, graphing and charting, presenting information with computer graphics and telecommunications.
5. Design and create a prototype of a system control area.

Science

1. Identify and discuss training and careers in communications
2. Show how to apply basic electronic laws and principles.
3. Identify resources and materials needed to operate a communication system.
4. Develop a timeline showing scientific breakthroughs leading to advanced communication technology.
5. Assess the impact of communication systems on the environment.
6. Discuss space-age communications as used by governmental and privately owned industries.
7. Locate & monitor satellites in space.

Reading/Spelling &Language Arts

1. Conduct an interview with someone working in the field of communications.
2. Explain the role of a translator in the world of telecommunications. Give examples of where these people work.
3. Explain how the world learned about the San Francisco earthquake of 1906 and compare how people learned of the most recent San Francisco earthquake.
4. Produce a dictionary of classroom technological jargon.
5. Study the body language of a news and/or whether reporter and present an oral report on your findings.

Social Studies

1. Trace the history of telecommunications development during the past 100 years.
2. Discuss how countries around the world 'share' telecommunications.
3. Discuss what is meant by power struggles within the industries involved in telecommunications.
4. Discuss the role of telecommunications with respect to worldwide news and weather coverage.
5. Make an inventory of personal communication use in the home.
6. Discuss how school communication systems operate.
7. Identify and discuss careers in communications.
8. Discuss the pros and cons for more 'up to the minute' and 'far reaching' telecommunications.
9. Discuss the cultural implication for telecommunications - resistance and receptivity.

P.E. and Health

1. Identify safety hazards associated with communications.
2. Identify health hazards of a sedentary and stressful occupation within the communication career field.

Problem Solving

1. Develop a non-verbal communication system and transmit a message among several class members.
2. Design a message for a cartoon. (cartoon is supplied)
3. Use magazine pictures to create a storyboard.
4. Produce a video designed to show someone how to do something.
5. Prepare a technology related radio commercial.

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*Technology resource journals available locally or at the University of Idaho, Industrial Technology Education Department.

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Technological Horizons in Education
TIES Journal
Popular Science

COMPUTER PROGRAMS:

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